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Impact of pesticides on human health and the profile of the farmer regarding their use

Impacto dos agrotóxicos para a saúde humana e o perfil do agricultor com relação ao seu uso

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A B S T R A C T

Pesticides are among the risk factors for workers' health and the environment. It has already been found that in the current agricultural production model, based on the intensive use of these inputs, either good health and preservation of the environment or productivity gains are prioritized. The objective of this work is to evaluate the impact of pesticides on human health and the profile of the farmer in relation to their use. This work is a descriptive analytical study, carried out in the county of Igreja Nova - AL, with 54 volunteers (sample size calculation obtained in the OpenEpi program). A questionnaire structured in 04 (four) axes was applied, which allowed the research of the following variables: personal data, living conditions, agricultural production process and health conditions of the workers. It was observed that 94.44% of the farmers participating in the research are male and with low level of education. Monoculture is the predominant agricultural style in the region (42.59%) and sugarcane is the main agricultural crop (85.19%). 17 pesticides were reported as used by farmers, highlighting 2,4-D; glyphosate and hexazinone. It´s important to note that 74.07% of the farmers stated that they did not use prescriptions in the purchase of these chemicals and that 54% reported not having received guidance on the correct form of use of these products. Regarding the protection of the farmer, 64% of farmers make use of some personal protective equipment (PPE) at the time of preparation of the product, and 94% at the time of its application in the field, highlighting the use of gloves, masks, pants and boots. The main means of pesticide application (98%) is the costal sprayer, with frequency of application every six months. Regarding the health status of the interviewees, 61.11% stated that they had no health problems. However, when asked about health problems presented in the act of handling the pesticide, 60% of the farmers reported mainly headaches (17.95%), dizziness (17.95%), change in vision (15.38%) and nausea (15.38%). And a worrying fact is that the majority (86%) reported not seeking the health service as a result of this health complaint. It´s therefore concluded that it´s important that more information related to the correct and safe use of pesticides and the health risks inherent to their use be made available to farmers, as a guarantee of their occupational health and physical integrity.

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R E S U M O

Os agrotóxicos estão entre os fatores de risco para a saúde dos trabalhadores e para o meio ambiente. Já foi constatado que no atual modelo de produção agrícola, baseado no uso intensivo desses insumos, ou se prioriza a boa saúde e a preservação do meio ambiente ou os ganhos de produtividade. O objetivo do presente trabalho é avaliar o impacto dos agrotóxicos para saúde humana e o perfil do agricultor com relação ao seu uso. Este trabalho trata-se de um estudo analítico descritivo, realizado no município de Igreja Nova – AL, com 54 voluntários (cálculo amostral obtido no programa OpenEpi). Foi aplicado um questionário estruturado em 04 (quatro) eixos, que possibilitou a pesquisa das seguintes variáveis: dados pessoais, condições de vida, processo de produção agrícola e condições de saúde dos trabalhadores. Foi observado que 94,44% dos agricultores participantes da pesquisa são do gênero masculino e com baixo nível de escolaridade. O monocultivo é o estilo agrícola predominante na região (42,59%) e a cana-de-açúcar é a cultura agrícola principal (85,19%). 17 agrotóxicos foram relatados como utilizados pelos agricultores, merecendo destaque 2,4-D; glifosato e hexazinona. É importante ressaltar que 74,07% dos agricultores afirmaram não fazer uso de receituário na compra desses produtos químicos e que 54% relatou não ter recebido orientação sob a forma correta de uso desses produtos. Com relação à proteção do agricultor, 64% dos agricultores fazem uso de algum equipamento de proteção individual (EPI) no momento da preparação do produto, e 94% no momento de sua aplicação no campo, destacando-se o uso de luvas, máscaras, calças e botas. O meio principal de aplicação de agrotóxicos (98%) é o pulverizador costal, com frequência de aplicação semestral. Com relação ao estado de saúde dos entrevistados, 61,11% afirmou não ter problemas de saúde. Entretanto, quando questionados sobre problemas de saúde apresentados no ato de manuseio do agrotóxico, 60% dos agricultores relataram principalmente dores de cabeça (17,95%), tontura (17,95%), alteração na visão (15,38%) e náuseas (15,38%). E um dado preocupante é que a maioria (86%) relatou não procurar o serviço de saúde em decorrência desta queixa de saúde. Conclui-se, então, que é importante que mais informações relacionadas ao uso correto e seguro de agrotóxicos e, os riscos à saúde inerentes ao seu uso, sejam disponibilizados para os agricultores, como garantia de sua saúde ocupacional e integridade física.

Palavras-Chave: Intoxicação, defensivos agrícolas, EPIs.

Introduction

The current stage of modern agriculture, immersed in a chemical-co-dependent production model, can be considered one of the poles that generate serious situations for the health of workers, the environment and populations (Queiroz et al., 2019).

Currently, human exposure to pesticides is an important national public health problem. The chemical production model dependent on agribusiness is responsible for promoting poisoning among workers and the population (Queiroz et al., 2019).

In Brazil, the implementation of the use of pesticides was done strategically, accompanied by technological packages that introduced mechanization on a large scale, associated with other factors of production through pre-established expenditures of state financing. In this process, the objective was to encourage the modernization of the territory to ensure increased production and productivity, but without considering risks to human health and the environment (Lopes & Albuquerque, 2018).

The imposition of the Green Revolution Policy (*Política da Revolução Verde*), the increase in "pests" in crops, the implementation of subsidized agricultural credits and the exemption from tax taxes, were factors that contributed to the increase in the consumption of pesticides and made Brazil the largest consumer of pesticides in the world (Lopes & Albuquerque, 2018).

In Alagoas, Brazil, agricultural practices represent an important segment of its economy, representing employment for a considerable portion of the population and the search for optimization of work and costs, in addition to increased productivity. It can be said

that the agriculture of Alagoas is linked to the dependent chemical model, inherited from the Green Revolution (*Revolução Verde*) (Lima et al., 2019).

Human exposure to pesticides has become a public health problem, emphasizing the need to organize health services to act in this area. A public health problem, resulting mainly from the indiscriminate use of pesticides, which has been drawing the attention of the Ministry of Health (*Ministério da Saúde - MS*) not only with regard to food safety and quality, but also with regard to the risks of exposure and intoxication of those who deal directly with the management of pesticides. Studies have shown that some active ingredients (AI) are promoters of many diseases, and it´s important to maintain strategies that allow the mapping and continuous surveillance of exposed populations (Neves et al., 2020).

Due to their intrinsic toxicity, pesticides impact human health, producing effects that vary according to the AI, the absorbed dose and the form of exposure. In addition, the wide use of these products, the lack of knowledge of the risks associated with their use, the disregard for safety standards in their handling, the free commercialization, the great commercial pressure on the part of the distribution and producer companies and the social problems found in the rural environment, are important causes that lead to the aggravation of the human and environmental contamination observed in Brazil (Petarli et al., 2019).

Pesticides cause acute diseases of mild and severe poisoning and that can lead to death (gastrointestinal, dermal, hepatic, renal, neurological, pulmonary and immune deficit) and chronic diseases, such as childhood cancers, changes in the reproductive system, neuropathies (deafness, decreased muscle strength, paralysis and Parkinson's disease), psychiatric (depression, cognitive disorders, autism), endocrine disruptors (diabetes, hypothyroidism, infertility, miscarriages), teratogenic (anencephaly, malformations), mutagenic (DNA defects), carcinogenic (breast, ovary, prostate, testicle, esophagus, and others) and immunodepressants (Pignat et al.; 2023)

According to the IBGE Agricultural Census (*Censo Agropecuário do IBGE*) (2017) all municipalities of Alagoas have establishments using pesticides, and the largest number of rural establishments is located in the municipalities located in the backwoods mesoregion (*Agreste*). The large number of rural establishments using pesticides in Alagoas is in line with the increased commercialization of the latter. Since 2010, the commercialization exceeds the level of 1000 tons/year, a result that places Alagoas in 16th place among the federation units and in 5th place among the states of the Northeast (Lima et al., 2019).

In Alagoas, 1,290 formulated products from various AIs were registered for commercialization and more than 50% of these products are classified as highly toxic to human health and highly dangerous to the environment. From 2008 to 2017, 1,086 notifications of agricultural pesticide poisoning were registered in Alagoas, with 27 deaths and 12 people with sequels confirmed, which places Alagoas among the states with the highest number of poisoning notifications per 100,000 inhabitants (LIMA et al., 2019).

The county of Igreja Nova, according to the IBGE, has a territorial area of 426.538 km², with an estimated population of 24,670 people, schooling level 6 to 14 years 97.9%. This county, according to the IBGE Agricultural Census (*Censo Agropecuário do IBGE*) (2017), stands out for the number of notifications for agricultural pesticide poisoning and the number of rural establishments using pesticides. It´s located in the central region east of Alagoas and inserted in the hydrographic basin of the São Francisco River, being bathed by the sub-basin of the Boa Cica River, which crosses it in the North-South direction, and by the Perucaba River, which crosses the western portion of the county. The Southern end of the county is bathed by the São Francisco River (Lima et al., 2019).

The importance of monitoring the impact of pesticide use on human health is irrefutable, especially in Alagoas, where studies on the evaluation of the impact of these substances on farmers' health are rare. Thus, the objective of this work is to evaluate the impact of pesticides on human health and the profile of the farmer in relation to their use.

Experimental part

The sociodemographic information, profile of use and understanding of the risks of pesticides were carried out in the health units of the county of Igreja Nova - AL, together with the workers of family and conventional cultivation. The inclusion of farmers in the research took place after a meeting of the researchers with the mayor of the county, the secretaries of health and agriculture, the managers of the respective secretariats and representatives of the agricultural community. In addition to compliance with the inclusion and exclusion criteria, and accepted by signing the Term of Free and Informed Consent (*Termo de Consentimento Livre e Esclarecido - TCLE*). The present study was approved by the Research Ethics Committee, as Opinion Number: 4,609,682.

Determination of the profile of the farmer in relation to the use of pesticides and its consequences

To obtain the population of farmers in the county of Igreja Nova - Alagoas in SIDRA, the following filters were used: Variable (Personnel employed in agricultural establishments); Typology (Family farming - yes); Gender (Total); Age range (Total); Total area groups (total); Year (2017); Territorial Unit (Brazil Federation Unit - Alagoas - Municipalities - 102), available at the link: https://sidra.ibge.gov.br/tabela/6885#resultado. These filters allowed the indication of the total number of 3,275 individuals of family agriculture for Igreja Nova - Alagoas. The sample size calculation was performed for the number of farmers included in the research through the OpenEpi program, available at the link: http://www.openepi.com/Menu/OE_Menu.htm, using the hypothetical % frequency of the

outcome factor in the population (p):99%+/-5, confidence limits such as % of 100(absolut +/-%)(d): 5% and, confidence interval of 99,9%. It was determined the *n*-amostral of 43 family farm volunteers. In this study, 54 volunteers participated.

The profile of the farmer, in relation to the use of pesticides and their consequences, was determined through the application of the questionnaire structured in 04 (four) axes, which enabled the research of the following variables: personal data, living conditions, agricultural production process and health conditions of workers. Its application took place at the headquarters of the Secretariat of Agriculture of the New Church (*Secretaria de Agricultura de Igreja Nova*).

Results and discussion

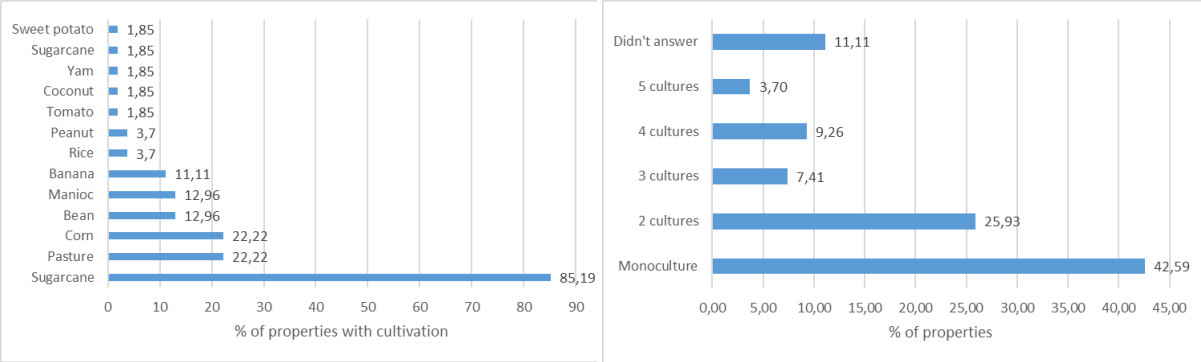
Determination of the profile of the farmer in relation to the use of pesticides and its consequences

It was identified that 94.44% of the farmers participating in the research are male. These data affirm that since the period since the period of primitive accumulation, the position of women both in the social sphere and in the production of labor power, was the result of a new patriarchal order, through a clear gender division of labor, based on the exclusion of women from wage labor and considering the context of family farming, it´s perceived that men are considered as the main workers, farmers and heads of the family (Bueno et al.; 2020). This statement is seen in practice, where according to the data obtained by the IBGE in the 2017 Agricultural Census, the number of rural producers totaled 5,072,152 producers, of which 4,100,900 were male, 945,490 were female and 25,762 producers did not identify with either of the two genders mentioned.

It was observed that 1.85% never went to school, 57.41% had incomplete elementary school, 9.26% had completed elementary school, 1.85% had not completed high school and 22.22% had completed high school. This is a frequent reality in Brazil, where about 15% of Brazilian agricultural workers have never attended school, 24% have only primary education and 19% elementary school (IBGE, 2017). Monoculture is the predominant agricultural style in the region (42.59%) and sugarcane is the main agricultural crop (85.19%) (Figure 1).

Figure 1.

Identification of crops and cultivation format in agricultural properties. Igreja Nova - AL. 2021/2022.

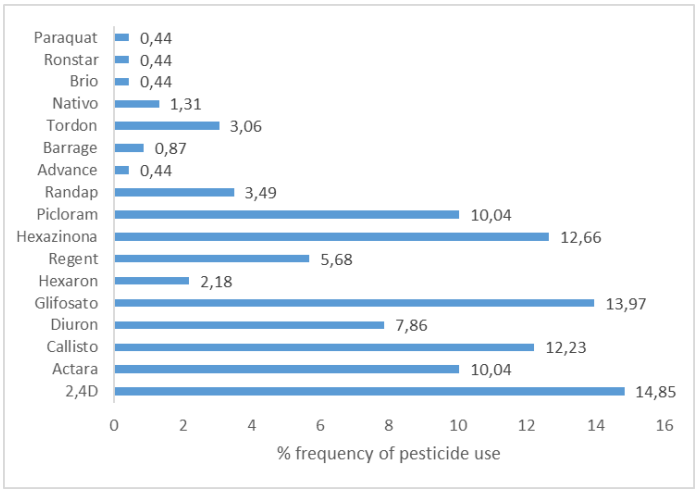


Source: The authors (2023).

Among the agrochemicals used in the properties participating in the research, 17 products were identified (Figure 2) as those used by farmers and the most frequently used: 2,4-D; glyphosate and hexazinone, a set of systemic herbicides that according to Matter et al. (2017) are widely used by farmers in various regions both in Brazil and worldwide. The herbicide 2,4 D is a non-toxic product. Anvisa (2010) classifies glyphosate as low toxic, Class IV. Hexazinone is a herbicide, with toxicological class category 5, being classified as a product unlikely to cause acute damage.

Figure 2.

Main agrochemical products for use by farmers in the county of Igreja Nova - Alagoas. 2021/2022.



Source: The authors (2023).

Despite glyphosate's relatively low toxicity, some of the components of its formulated products have it higher than the active ingredient. Although the acute toxicity of glyphosate is considered low, it has been suggested that the herbicide may cause chronic birth defects in

certain animal species when administered at high doses and for a prolonged period (Amarante Junior, 2002).

In plants, glyphosate has great toxicity, except in suberized stems. Among the acute and chronic effects in humans are mentioned: contact dermatitis and toxic syndrome after ingestion of high doses. In aquatic environments, the toxicity of glyphosate is accentuated with increasing temperature and pH (Corcino et al., 2019).

In the list of agrochemical products used in the region under study (Figure 2) are Actara, Picloran, Diuron, Regent, Randap, Tordon, Hexaron, Nativo, Barrage, Advance, Brio, Ronstar and Paraquat, agrochemicals that have released commercialization in the region. Several municipalities in Alagoas are dependent on the use of pesticides in crops, among which it´s possible to highlight São Sebastião, Arapiraca, Feira Grande, Igaci, Limoeiro de Anadia, Lagoa da Canoa, Taquarana, among others (Lima et al., 2019).

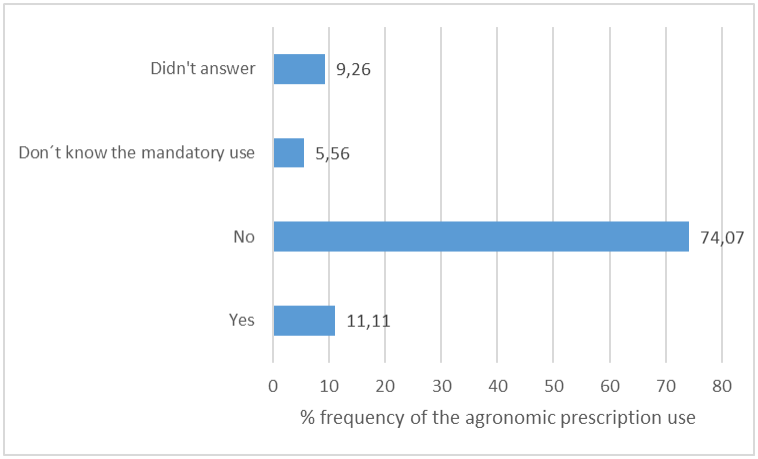
The agencies that allow the use and consumption, commercialization, in addition to import and export in Brazil are the Ministry of the Environment and the Ministry of Agriculture, Livestock and Supply (*Ministério do Meio Ambiente and Ministério da Agricultura, Pecuária e Abastecimento*), after the authorization of three regulatory bodies: the National Health Surveillance Agency (*Agência Nacional de Vigilância Sanitária - Anvisa*), of the Ministry of Health (*Ministério da Saúde*); the Brazilian Institute of the Environment and Renewable Natural Resources (*Instituto Brasileiro do Meio Ambiente e dos Recursos Naturais Renováveis - Ibama*) and the Ministry of Agriculture, Livestock and Supply (*Ministério da Agricultura, Pecuária e Abastecimento*), which are responsible for assessing the potential impacts on health, the environment and agronomic effectiveness (Friedich et al., 2021).

Among the products that most present risks to human health are orgaphosphates, carbamates, pyrethroids and organochlorines, which are banned in many countries, but still found in pesticides, with glyphosate being the best selling in Brazil and in the world (Aertes et al., 2019).

In Brazil, the sale of pesticides can only be done with revenue. It´s a legal requirement, established by Federal Law No. 7,802/89, and the revenue must be issued by authorized professionals, such as agronomists and agricultural technicians. In addition, the frequency of application is weekly and most rural workers do not use agronomic prescriptions and do not have access to specialized guidance, which evidences risk factors for poisoning according to literature data. Although some participants reported having already suffered from poisoning resulting from the use of pesticides, a very small number turned to the health system to assess the situation (Corcino et al., 2019). It´s important to emphasize that 74.07% of the interviewees stated that they did not use prescriptions in the purchase of these chemicals. Some interviewees (5.56%) did not know about the need to present the prescription for the purchase, which denotes a lack of knowledge of the rules for the acquisition of these products (Figure 3).

Figure 3.

Use of agronomic prescriptions for the purchase of pesticides. Igreja Nova - AL. 2021/2022.



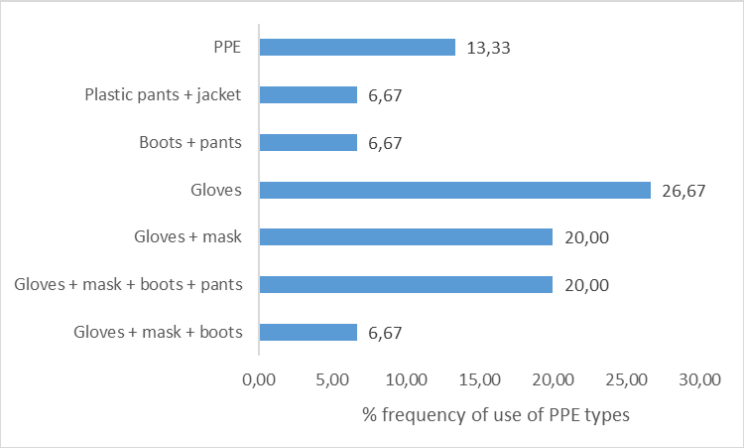
Source: The authors (2023).

The exposure of farmers to pesticides is a reality observed in the region, and it was found that 54% of the interviewees reported not having received guidance on the correct form of use of these products. Among the 46% interviewees who reported having received guidance on the correct use of pesticides, and that it was carried out by the Development Company of the Vale São Francisco and Parnaíba (*Companhia de Desenvolvimento do Vale do São Francisco e do Parnaíba - CODEVASF*), Agricultural Defense and Inspection Agency of Alagoas (*Agência de Defesa e Inspeção Agropecuária de Alagoas - ADEAL*), farmers association, agricultural technician and commercial representative

It was found that regarding the protection of the farmer, 64% of the interviewees make use of some personal protective equipment (PPE) at the time of preparation of the product, and 94% at the time of its application in the field, highlighting the use of gloves, masks, pants and boots (Figure 4).

Figure 4.

PPE used by farmers at the time of preparation and application of pesticides. Igreja Nova - AL. 2021/2022.



Source: The authors (2023).

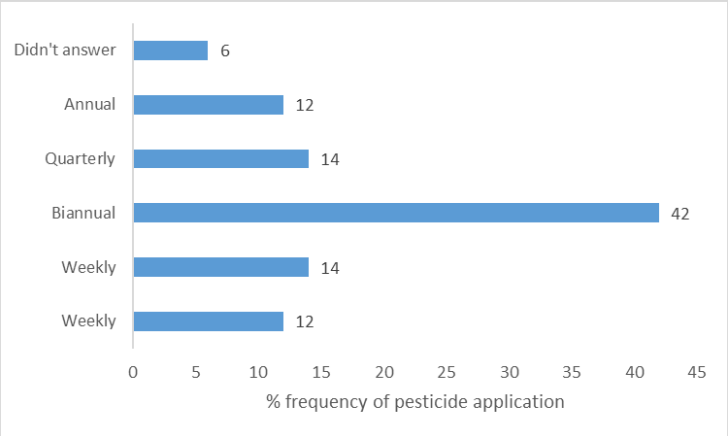
The use of pesticides by the rural population has caused several aggravating factors both environmental and human health, resulting from factors such as the misuse/handling of these products, absence of PPE, the high toxicity index of some pesticides, among others. Studies show that the toxicological effects of pesticides include both mortality as well as neurological abnormalities, reproduction and behavior (Bento et al., 2020). It´s also noteworthy that some substances are characterized by being highly toxic and carcinogenic (Peres et al., 2007).

NR31 of October 20th, 2020 is the government standard that regulates the types of safety devices that must be offered and what are the conditions of hygiene, comfort and suitability for field workers to succeed in their tasks. NR31 was amended by SEPRT Ordinance No. 22,677, of October 22nd, 2020 (Brazilian Labor Guide) (Guia Trabalhista, 2022).

Another important factor in the process of using agrochemicals concerns the equipment used in the application and the frequency of use of the various products. It was verified that 98% of the interviewees apply pesticides to their crops through the use of costal sprayers, which causes direct contact with the product and only 2% use tractors for this activity. The main frequency of pesticide application identified for the study region is the semiannual (42%) (Figure 5).

Figure 5.

Frequency of pesticide application by farmers of Igreja Nova - Alagoas. 2021/2022.

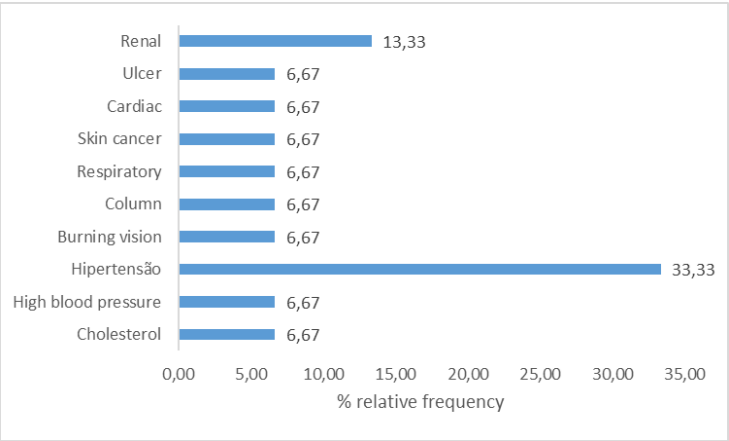


Source: The authors (2023).

Regarding the health status of the interviewees, 61.11% stated that they had no health problems, 24.07% reported having some health problem, and the others did not know and/or wanted to answer this question. The most cited health problems were renal (13.33%) and hypertension (33,33%) (Figure 6).

Figure 6.

Main health problems reported by farmers of Igreja Nova - Alagoas. 2021/2022.

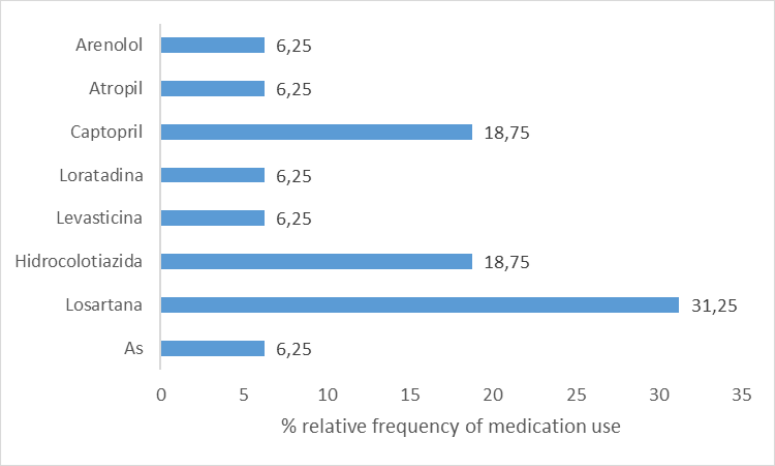


Source: The authors (2023).

According to farmers reports, it was identified that 60% monitor health, mainly performed in Basic Health Units (*Unidades Básicas de Saúde*) (92.59%) and that the most used drugs are: Losartan (31.25%), hydrochlorothiazide (18.75%) and captopril (18.75%) (Figure 7).

Figure 7.

Medicines used by farmers in Igreja Nova - Alagoas. 2021/2022.



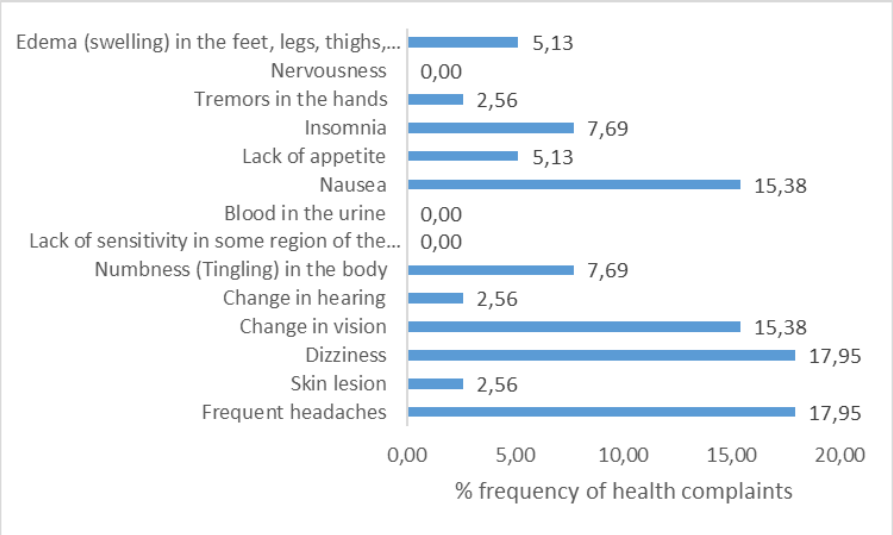
Source: The authors (2023).

Such drugs are first-line antihypertensives, and losartan is a drug of the class of angiotensin receptor antagonists, where there is inhibition of vasoconstriction and decrease in aldosterone synthesis, generating a decrease in blood pressure. Captopril acts by competitively inhibiting ACE (Angiotensin-Converting Enzyme), thereby decreasing the conversion of angiotensin I into angiotensa II which is a potent vasoconstrictor. Hydrochlorothiazide inhibits the reabsorption of sodium and chloride in the ascending branch of the loop of Henle and distal tubules, increasing urinary excretion of sodium and chlorides. These results are similar to those found in other studies, in which diuretics and antagonists of the renin-angiotensin system are the most used drugs for the treatment of hypertension (Mengue, 2016).

When asked about health problems presented in the act of handling the pesticide, it was identified that 60% of the interviewees reported feeling some health problem, with the main complaints: headaches (17.95%), dizziness (17.95%), change in vision (15.38%) and nausea (15.38%) (Figure 8). A worrying fact is that most of the interviewees (86%) reported not seeking the health service due to this health complaint.

Figure 8.

Main health problems when applying pesticides reported by farmers of Igreja Nova - Alagoas. 2021/2022.



Source: The authors (2023).

Data on pesticide poisoning are underreported and invisible in health statistics, since the World Health Organization - WHO (*Organização Mundial da Saúde - OMS*) estimates that for each reported case there are another 50 unregistered cases (Da Silva et al., 2022).

CONCLUSION

It was clear in this study that the vast majority of farmers have a low level of education, which tends to impact on the proper reading of the leaflets of pesticides and on the care regarding the use of PPE. Another factor that has great repercussions on the health of farmers is the fact that the vast majority of respondents do not use technical assistance from an agronomist or agricultural technician and consequently do not buy pesticides with the agronomic prescription in commercial establishments in the region. The pesticides most used by farmers are herbicides, especially 2,4-D; glyphosate and hexazinone, classified as systemic herbicides. It should be noted that most farmers reported some health problem, especially headaches, dizziness, altered vision and nausea, but it´s part of their daily lives not to seek health services as a result of this health complaint. So it´s important that more information related to the correct and safe use of pesticides and the health risks inherent in their use are made available to farmers, as a guarantee of their occupational health and physical integrity.

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